3.4.2 Mechanical properties of matter

	Learning outcomes	Additional guidance
	Learners should be able to demonstrate and apply their knowledge and understanding of:	
(a)	force–extension (or compression) graph; work done is area under graph	*M3.1*
(b)	elastic potential energy; $E = \frac{1}{2}Fx$; $E = \frac{1}{2}kx^2$	*M0.5, M3.12*

(6) M - sketch force extension graphs of different materials
(7) S - Use techniques to investigate the force extension graph of a strawberry lace
(8) C - Apply the equation for elastic potential energy

Lesson 3. EPE

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S
A

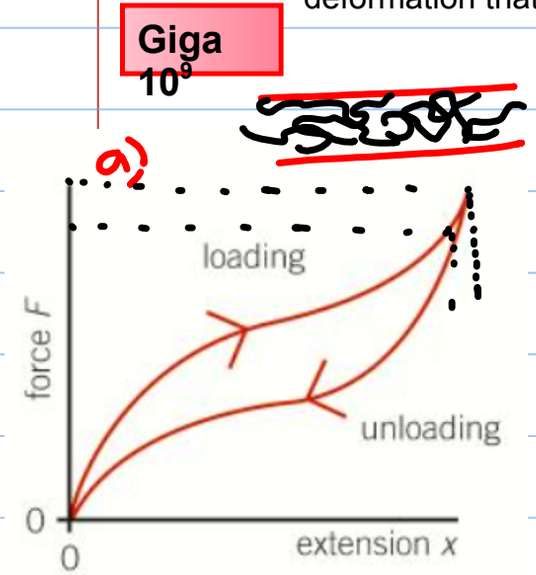
STARTER: sketch the force / extension curve for:
a) a rubber band
b) a polythene strip.

Kilo 10^3

Mega 10^6

Giga 10^9

Ex 1 - Explain how the graph demonstrates the types of deformation that occur



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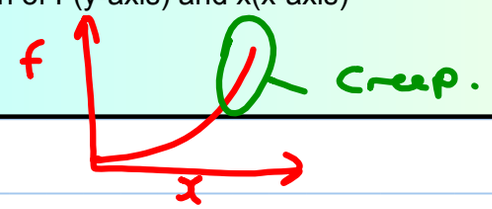
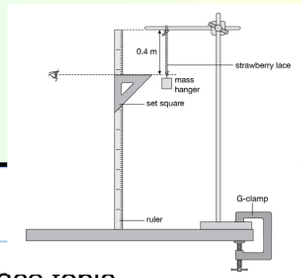
ACTIVITY 1: Strawberry laces practical. - use the 10g masses

- Draw a suitable table to load and unload the lace.
- Plot a graph of F(y-axis) and x(x-axis)





Kilo 10^3

Mega 10^6 **Ex 1** - How does this activity link to the space topic

Giga 10^9

Questions

1 Which of these words best describes the behaviour of a strawberry lace and why? *(2 marks)*

Hard Ductile Brittle

2 Does a strawberry lace obey Hooke's law? (*2 marks*)

3 The strawberry laces demonstrate a phenomenon known as creep. What do you think that is and how did you take it into account when recording the new length of the lace? (*2 marks*)

4 Using your observations and results identify the point on your graph at which the strawberry lace began to deform plastically. Explain your choice. (*2 marks*)

Answers for method sheet

1 Ductile. (*1 mark*)

The strawberry laces deform plastically and are drawn into longer laces before breaking. (*1 mark*)

2 Laces do not obey Hooke's law. (*1 mark*)

The force is not directly proportional to the extension. (*1 mark*)

3 Creep is the phenomenon where the lace continues to extend after the load is added. (*1 mark*)

Students can either:

- use initial readings (*1 mark*)
- wait a set period of time before taking them. (*1 mark*)

Both methods are equally valid.

4 Look at their results table – from experience the laces do not return to their original length when the load is removed very early on in the loading. (*1 mark*)

So they should identify a point early in their graph. (*1 mark*)

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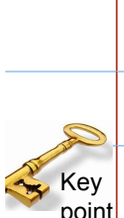

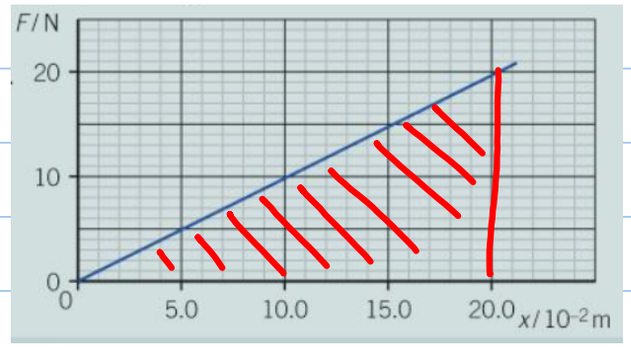

How could we calculate the work done in extending this spring? Discuss

area under a force - extension graph = **work done**

Find the work done in this case.

What is the equation you have used?

E = 1/2 Fx

$E = \frac{1}{2}kx^2$

E = Elastic potential energy stored

Ex: What is the relationship between energy and extension?

$F = kx$

E = 1/2 Fx

substituting in using Hooke's law...

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ACTIVITY 1: Compare and contrast nuclear fission and nuclear fusion.
FoR - How does this activity link to the space topic

HWK:

Kilo 10^3 **Support** - How does this activity link to the space topic

Mega 10^6 **Ex 1** - How does this activity link to the space topic

Giga 10^9 **Ex 2** - How does this activity link to the space topic


Key point

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